



## COL7A1 gene

collagen type VII alpha 1 chain

### Normal Function

The *COL7A1* gene provides instructions for making proteins that are used to assemble type VII collagen. Collagens are a family of proteins that strengthen and support connective tissues, such as skin, bone, tendons, and ligaments, throughout the body. In particular, type VII collagen plays an essential role in strengthening and stabilizing the skin.

The proteins produced from the *COL7A1* gene, called pro- $\alpha$ 1(VII) chains, are the components of type VII collagen. Three pro- $\alpha$ 1(VII) chains twist together to form a triple-stranded, ropelike molecule known as a procollagen. Procollagen molecules are secreted by the cell and processed by enzymes to remove extra protein segments from the ends. Once these molecules are processed, they arrange themselves into long, thin bundles of mature type VII collagen.

Type VII collagen is the major component of structures in the skin called anchoring fibrils. These fibrils are found in a region known as the epidermal basement membrane zone, which is a two-layer membrane located between the top layer of skin, called the epidermis, and an underlying layer called the dermis. Anchoring fibrils hold the two layers of skin together by connecting the epidermal basement membrane to the dermis.

### Health Conditions Related to Genetic Changes

#### dystrophic epidermolysis bullosa

More than 400 mutations in the *COL7A1* gene have been identified in people with dystrophic epidermolysis bullosa. These mutations alter the structure or disrupt the production of type VII collagen, which impairs the ability of anchoring fibrils to connect the epidermis to the dermis. When type VII collagen is abnormal or missing, anchoring fibrils cannot form properly. As a result, friction or other minor trauma can cause the two skin layers to separate. This separation leads to the formation of blisters, which can result in extensive scarring as they heal.

The autosomal recessive types of dystrophic epidermolysis bullosa (RDEB) result from mutations in both copies of the *COL7A1* gene in each cell. The most severe, classic form of this disorder is known as the Hallopeau-Siemens type (RDEB-HS). Most of the *COL7A1* mutations responsible for RDEB-HS significantly reduce or eliminate the production of type VII collagen. As a result, few or no anchoring fibrils are present to connect the epidermis with the dermis. This lack of anchoring fibrils

causes the severe signs and symptoms of RDEB-HS. A somewhat less severe form of autosomal recessive dystrophic epidermolysis bullosa, known as the non-Hallopeau-Siemens type (Non-HS RDEB), is caused by other types of mutations. These genetic changes allow a small amount of normal or partially functional type VII collagen to be produced.

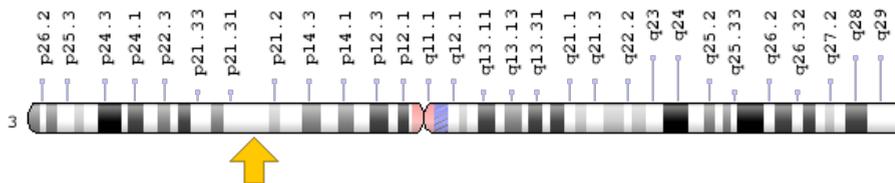
A milder, autosomal dominant form of dystrophic epidermolysis bullosa (DDEB) results from mutations in one copy of the *COL7A1* gene in each cell. In many cases, these mutations occur in a part of type VII collagen known as the collagenous region. This region gives type VII collagen its usual triple-stranded structure. It is made up of a pattern of protein building blocks (amino acids) in which every third amino acid is a glycine. Mutations that substitute other amino acids for glycine in this region can disrupt the triple-stranded structure of type VII collagen. When the abnormally shaped collagen molecules are incorporated into anchoring fibrils, they interfere with the fibrils' normal function and prevent them from effectively connecting the epidermis and the dermis. DDEB can also be caused by other types of mutations, particularly changes that affect the folding of type VII collagen.

It is unclear how *COL7A1* mutations are associated with an increased risk of certain cancers, particularly squamous cell carcinoma, in people with severe types of dystrophic epidermolysis bullosa. Some research has suggested that abnormal forms of type VII collagen that retain a fragment called the NC1 domain may increase the risk of tumor formation. Other studies, however, have not found this association.

### Chromosomal Location

Cytogenetic Location: 3p21.31, which is the short (p) arm of chromosome 3 at position 21.31

Molecular Location: base pairs 48,564,073 to 48,595,302 on chromosome 3 (Homo sapiens Annotation Release 108, GRCh38.p7) (NCBI)



Credit: Genome Decoration Page/NCBI

### Other Names for This Gene

- alpha 1 type VII collagen
- CO7A1\_HUMAN

- collagen type VII alpha 1
- collagen VII, alpha-1 polypeptide
- collagen, type VII, alpha 1
- collagen, type VII, alpha 1 (epidermolysis bullosa, dystrophic, dominant and recessive)
- EBD1
- EBDCT
- EBR1
- LC collagen
- long chain collagen

## **Additional Information & Resources**

### Educational Resources

- Molecular Biology of the Cell (fourth edition, 2002): Collagens Are the Major Proteins of the Extracellular Matrix  
<https://www.ncbi.nlm.nih.gov/books/NBK26810/#A3551>

### GeneReviews

- Dystrophic Epidermolysis Bullosa  
<https://www.ncbi.nlm.nih.gov/books/NBK1304>

### Scientific Articles on PubMed

- PubMed  
<https://www.ncbi.nlm.nih.gov/pubmed?term=%28COL7A1%5BTIAB%5D%29+AND+%28%28Genes%5BMH%5D%29+OR+%28Genetic+Phenomena%5BMH%5D%29%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+1800+days%22%5Bdp%5D>

### OMIM

- COLLAGEN, TYPE VII, ALPHA-1  
<http://omim.org/entry/120120>

### Research Resources

- Atlas of Genetics and Cytogenetics in Oncology and Haematology  
[http://atlasgeneticsoncology.org/Genes/GC\\_COL7A1.html](http://atlasgeneticsoncology.org/Genes/GC_COL7A1.html)
- ClinVar  
<https://www.ncbi.nlm.nih.gov/clinvar?term=COL7A1%5Bgene%5D>

- HGNC Gene Family: Collagens  
<http://www.genenames.org/cgi-bin/genefamilies/set/490>
- HGNC Gene Family: Fibronectin type III domain containing  
<http://www.genenames.org/cgi-bin/genefamilies/set/555>
- HGNC Gene Symbol Report  
[http://www.genenames.org/cgi-bin/gene\\_symbol\\_report?q=data/hgnc\\_data.php&hgnc\\_id=2214](http://www.genenames.org/cgi-bin/gene_symbol_report?q=data/hgnc_data.php&hgnc_id=2214)
- NCBI Gene  
<https://www.ncbi.nlm.nih.gov/gene/1294>
- UniProt  
<http://www.uniprot.org/uniprot/Q02388>

### Sources for This Summary

- Bruckner-Tuderman L, Höpfner B, Hammami-Hausli N. Biology of anchoring fibrils: lessons from dystrophic epidermolysis bullosa. *Matrix Biol.* 1999 Feb;18(1):43-54. Review.  
*Citation on PubMed:* <https://www.ncbi.nlm.nih.gov/pubmed/10367730>
- Dang N, Klingberg S, Marr P, Murrell DF. Review of collagen VII sequence variants found in Australasian patients with dystrophic epidermolysis bullosa reveals nine novel COL7A1 variants. *J Dermatol Sci.* 2007 Jun;46(3):169-78. Epub 2007 Apr 10. Review.  
*Citation on PubMed:* <https://www.ncbi.nlm.nih.gov/pubmed/17425959>
- Gardella R, Castiglia D, Posteraro P, Bernardini S, Zoppi N, Paradisi M, Tadini G, Barlati S, McGrath JA, Zambruno G, Colombi M. Genotype-phenotype correlation in Italian patients with dystrophic epidermolysis bullosa. *J Invest Dermatol.* 2002 Dec;119(6):1456-62.  
*Citation on PubMed:* <https://www.ncbi.nlm.nih.gov/pubmed/12485454>
- GeneReview: Dystrophic Epidermolysis Bullosa  
<https://www.ncbi.nlm.nih.gov/books/NBK1304>
- Järvikallio A, Pulkkinen L, Uitto J. Molecular basis of dystrophic epidermolysis bullosa: mutations in the type VII collagen gene (COL7A1). *Hum Mutat.* 1997;10(5):338-47.  
*Citation on PubMed:* <https://www.ncbi.nlm.nih.gov/pubmed/9375848>
- Kern JS, Kohlhase J, Bruckner-Tuderman L, Has C. Expanding the COL7A1 mutation database: novel and recurrent mutations and unusual genotype-phenotype constellations in 41 patients with dystrophic epidermolysis bullosa. *J Invest Dermatol.* 2006 May;126(5):1006-12.  
*Citation on PubMed:* <https://www.ncbi.nlm.nih.gov/pubmed/16484981>
- Ortiz-Urda S, Garcia J, Green CL, Chen L, Lin Q, Veitch DP, Sakai LY, Lee H, Marinkovich MP, Khavari PA. Type VII collagen is required for Ras-driven human epidermal tumorigenesis. *Science.* 2005 Mar 18;307(5716):1773-6.  
*Citation on PubMed:* <https://www.ncbi.nlm.nih.gov/pubmed/15774758>
- Pourreyron C, Cox G, Mao X, Volz A, Baksh N, Wong T, Fassihi H, Arita K, O'Toole EA, Ocampo-Candiani J, Chen M, Hart IR, Bruckner-Tuderman L, Salas-Alanis JC, McGrath JA, Leigh IM, South AP. Patients with recessive dystrophic epidermolysis bullosa develop squamous-cell carcinoma regardless of type VII collagen expression. *J Invest Dermatol.* 2007 Oct;127(10):2438-44. Epub 2007 May 10.  
*Citation on PubMed:* <https://www.ncbi.nlm.nih.gov/pubmed/17495952>

- Sawamura D, Goto M, Yasukawa K, Sato-Matsumura K, Nakamura H, Ito K, Nakamura H, Tomita Y, Shimizu H. Genetic studies of 20 Japanese families of dystrophic epidermolysis bullosa. *J Hum Genet.* 2005;50(10):543-6. Epub 2005 Sep 28. Erratum in: *J Hum Genet.* 2006;51(9):839.  
*Citation on PubMed:* <https://www.ncbi.nlm.nih.gov/pubmed/16189623>
  - Varki R, Sadowski S, Uitto J, Pfendner E. Epidermolysis bullosa. II. Type VII collagen mutations and phenotype-genotype correlations in the dystrophic subtypes. *J Med Genet.* 2007 Mar;44(3):181-92. Epub 2006 Sep 13.  
*Citation on PubMed:* <https://www.ncbi.nlm.nih.gov/pubmed/16971478>  
*Free article on PubMed Central:* <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2598021/>
- 

Reprinted from Genetics Home Reference:  
<https://ghr.nlm.nih.gov/gene/COL7A1>

Reviewed: January 2008  
Published: March 21, 2017

Lister Hill National Center for Biomedical Communications  
U.S. National Library of Medicine  
National Institutes of Health  
Department of Health & Human Services